

[54] **INTRACONNECTOR WIRING CHANGE
MODULE**

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[52] U.S. Cl. **339/18 R, 339/17 L, 339/157 R,**
339/176 M, 339/198 R, 339/276 A
[51] Int. Cl. **H01r 29/00**
[58] Field of Search 339/18, 17, 94, 154, 176

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[57] **ABSTRACT**

The module is provided with input and output electrical contacts which are arranged to receive conventional cable terminations. The input and output contacts are respectively brought out from the interior of the module body to exposed connection pins. There are as many exposed connection pins as there are input and output contacts. Connections are made between or among the several connection pins by conventional means in order to change the scheme or arrangement of wiring connections in an electronic apparatus to another connection scheme. An insulating and sealing cover or permanent potting may be placed over the pins to protect the newly made connections.

13 Claims, 14 Drawing Figures

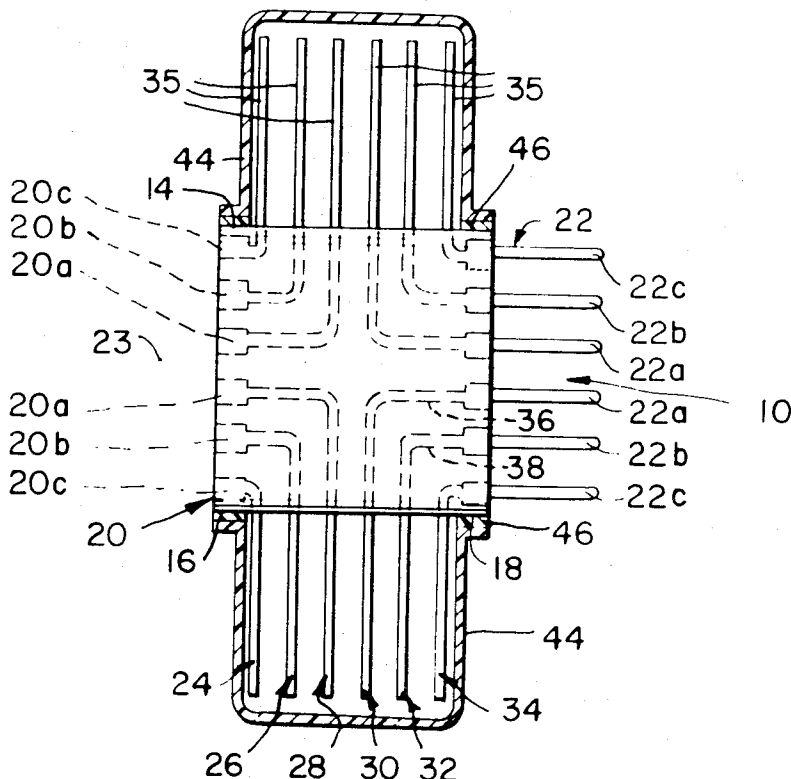


Fig. 1a

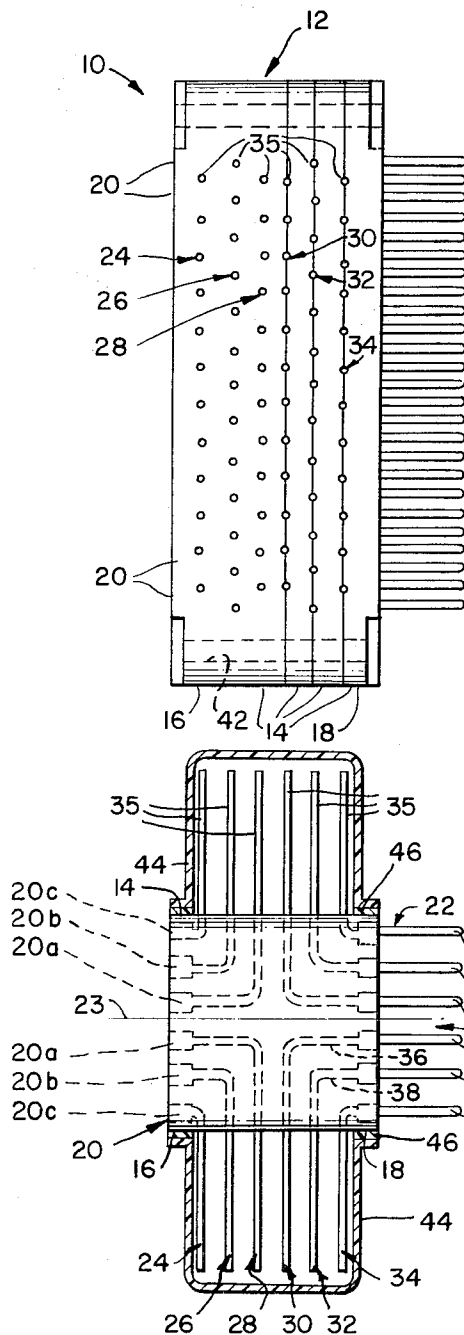


Fig. 1b.

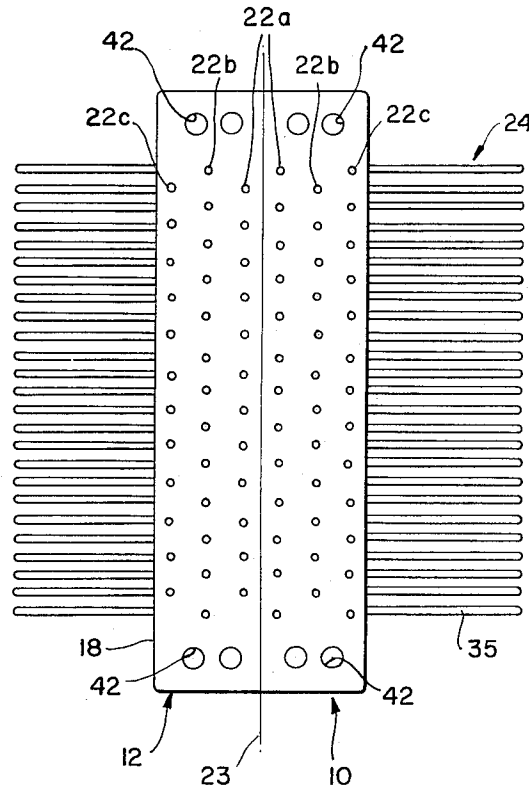


Fig. 1c.

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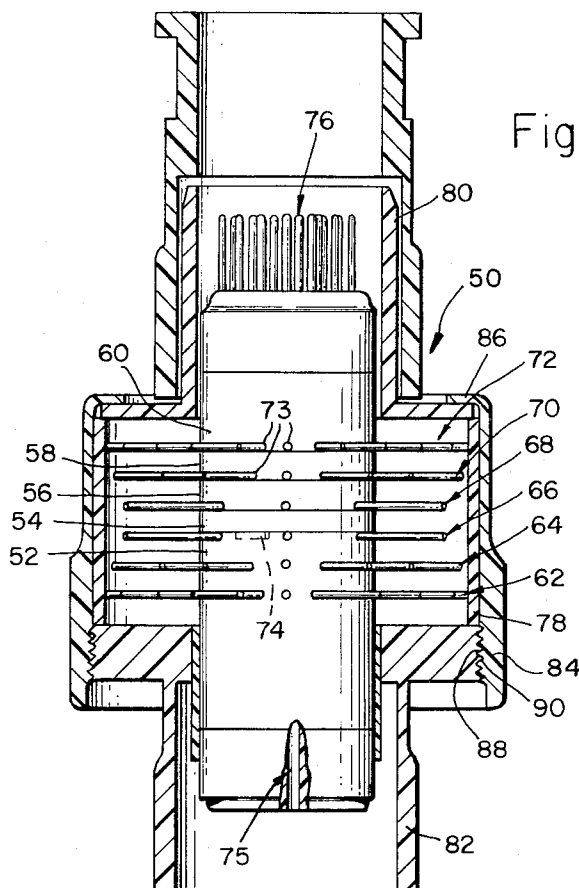


Fig. 2a.

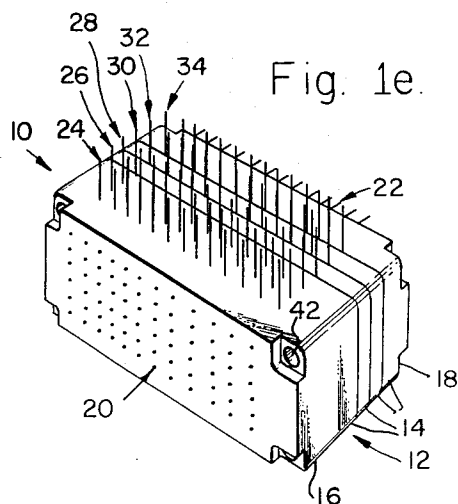


Fig. 1e.

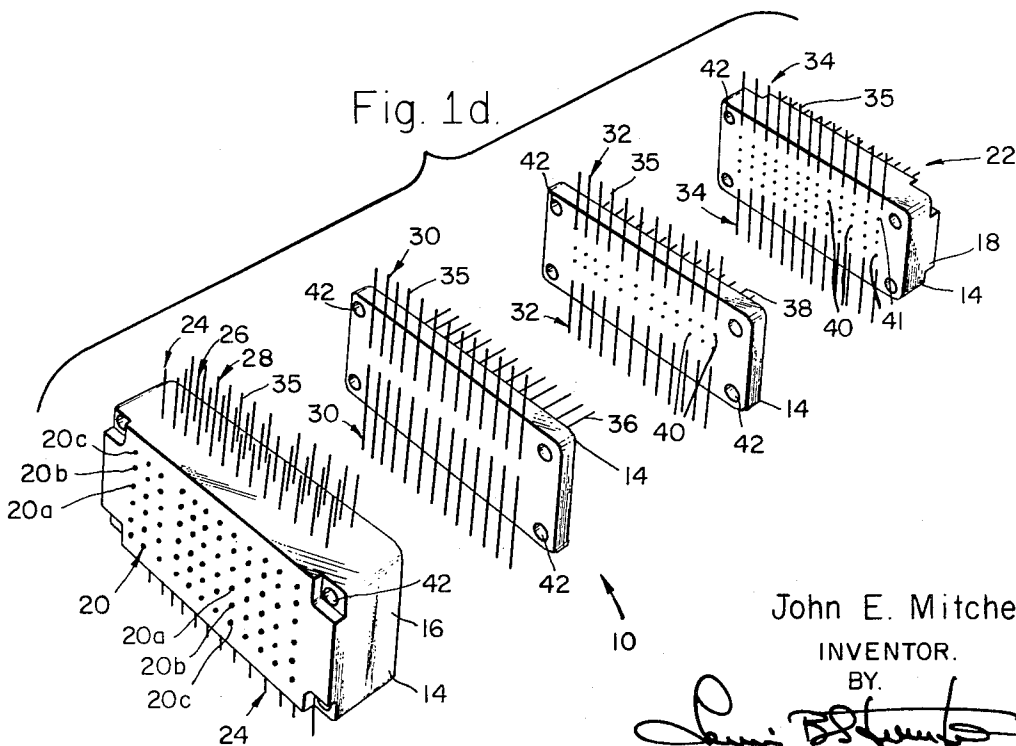


Fig. 1d.

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Fig. 2c.

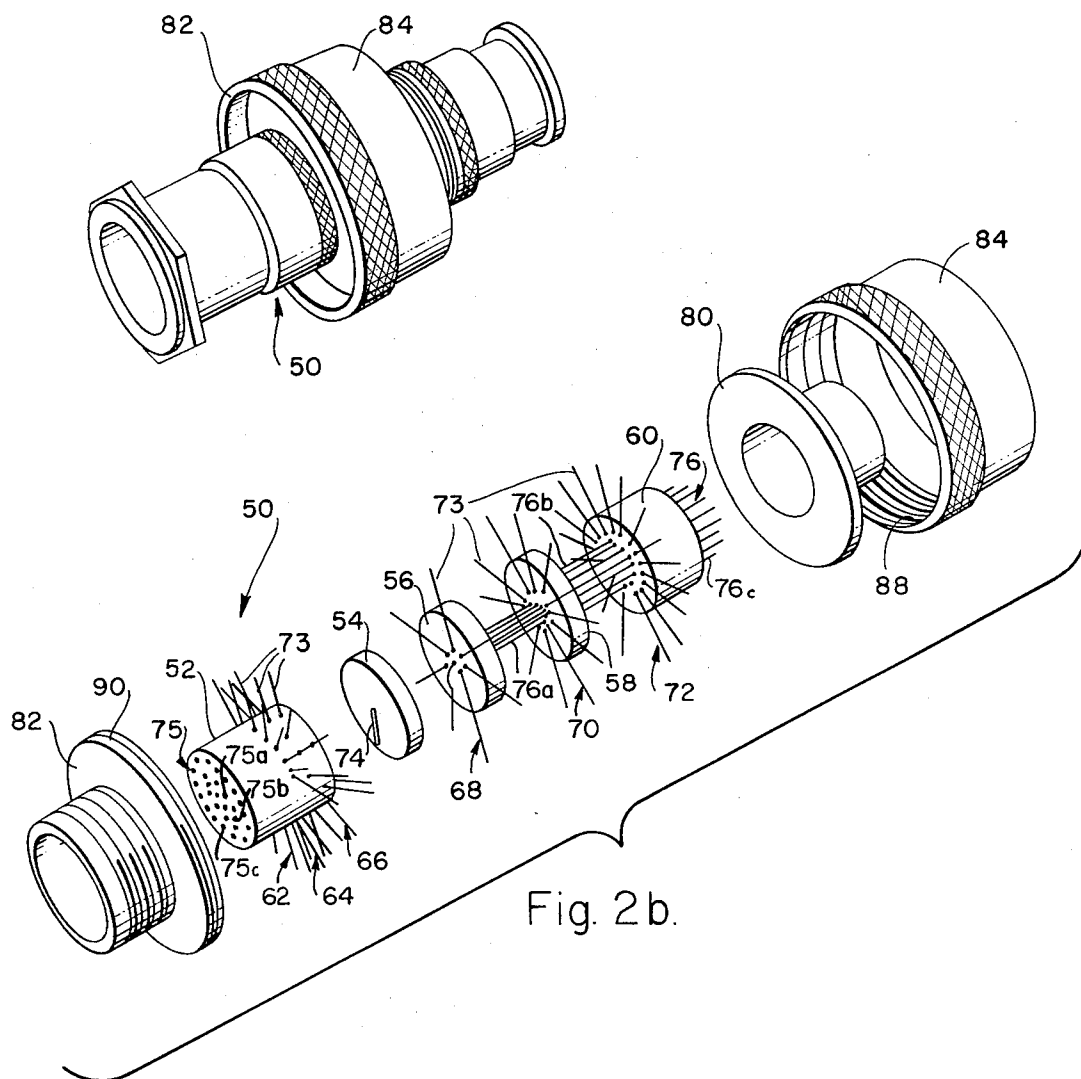


Fig. 2b.

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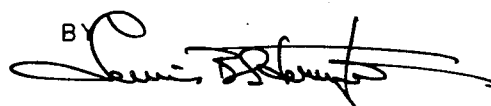
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Fig. 3b.

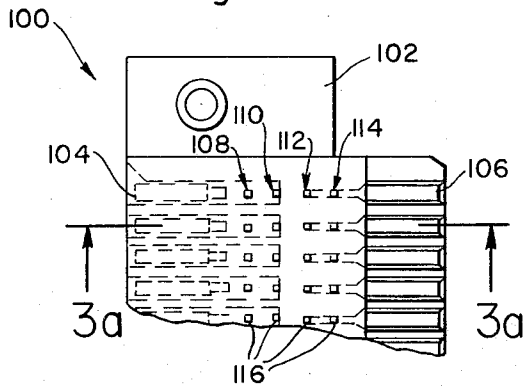


Fig. 3a.

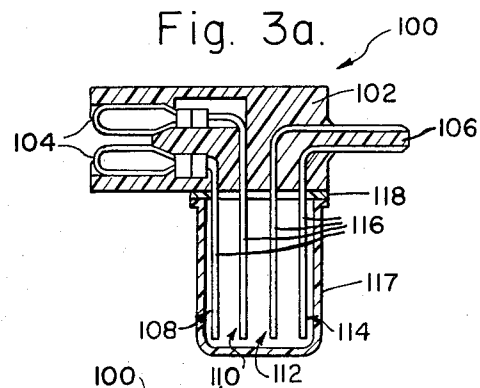


Fig. 3c.

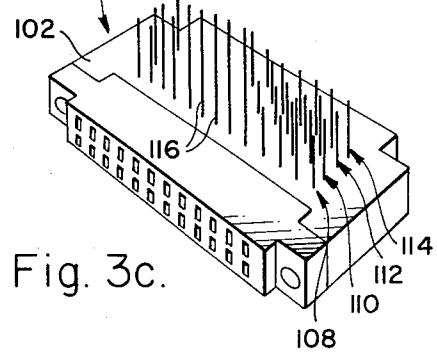


Fig. 4a.

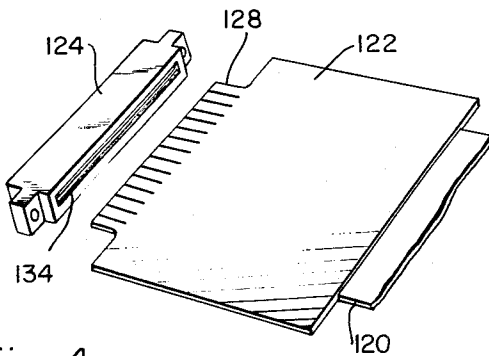


Fig. 4b.

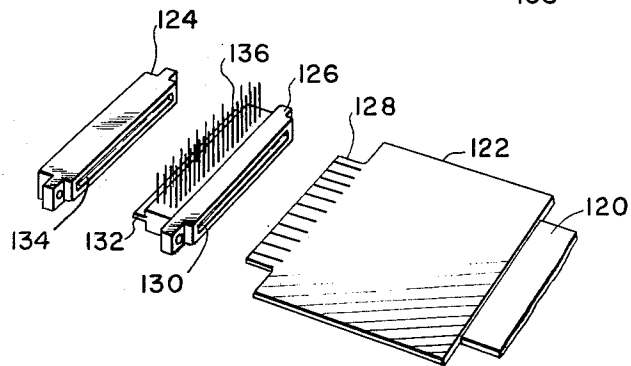
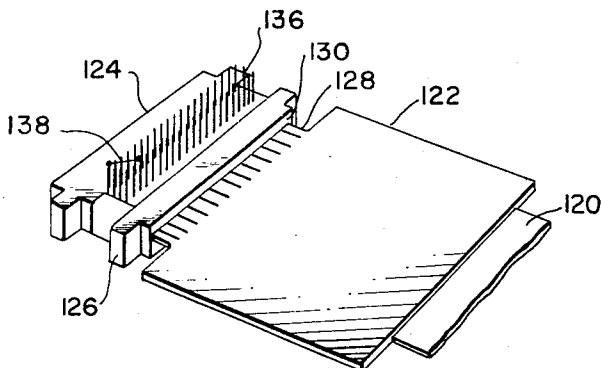


Fig. 4c.



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INTRACONNECTOR WIRING CHANGE MODULE

The present invention relates to an apparatus and method for changing the scheme or arrangement of wiring connections in an electronic apparatus to another connection scheme.

Electrical connections among electronic components are generally made by use of multiple wire cables being in such shapes or arrangements as radial, flat ribbon, and harness. Because such cables contain a plurality of leads, once the wiring design has been formulated and the wires have been connected among components, wiring changes cannot be readily made.

Nevertheless, during various stages of design, testing, prototype, production retrofit, evolutionary development or development of a family of wiring schemes, previously produced cabling, harness systems, and/or wiring connection schemes usually require changes. Such changes have been conventionally accomplished by cutting, rearranging, and/or splicing the wires or by removing and replacing the entire cable with a newly designed cable containing the desired wiring changes. Special devices, such as the so-called "patch panel" have also been utilized. Regardless of the particular changing method used, all schemes are inefficient and wasteful. Cutting and/or splicing does not provide for a neat connection, and replacement of cables is expensive in that the old cable is discarded. In addition, considerable time is lost implementing the changes.

The present invention overcomes these and other problems by utilization of a special module provided with input and output electrical contacts which are arranged to receive conventional cable termination male and female pins and sockets. Both the input and output contacts are housed within a dielectric body and preferably open at opposed ends thereof. The input contacts are brought out from the interior of the body to wire-wrap or other exposed connection pins which extend from the side of the module and, similarly, the output contacts at the other end of the module are brought out to connection pins also on the side of the module. There are as many connection, wire-wrap and the like pins as there are contacts and there are as many input and output contacts as there are respective cable wires.

Connections are made between or among the several wire-wrap pins by conventional automatic or manually operated or wire-wrap tools to effect the desired wiring connections in the new scheme. Alternate methods of making connections such as sliding sleeve, welding, crimping, or soldering operations can also be used in this scheme. An insulating and sealing cover may then be placed over the pins to protect the newly made connections, or permanent potting may be used.

The inventive module is useful for connecting two sections of cable or to connect a section of cable and the device into which the cable normally plugs. This connection may be a simple plugging together or may additionally utilize key and lock, screw attachments, and the like.

It is, therefore, an object of the present invention to provide for a simple and lightweight wiring change method and device.

Another object is the provision of bringing out any cable conductor to any connector contact.

Another object is to provide for making repeated changes in wiring schemes.

Another object is the provision of a method and device for readdressing and reterminating cable connections without removal of the cable from its location or position.

Another object is to provide a device which can be removed from its interim interface position in a harness or cable, revised to readdress the interface remotely, and reinstalled in the same harness interface to effect wiring changes.

Another object is the provision of a device which can accept any electrical termination, such as wire-wrap, sliding sleeve, crimp, solder, or welded interim terminations, either in its cable or harness interface position or at a location remote therefrom.

Another object is to provide a device which, when introduced between interface connectors, mates with both connector halves and exposes each end of each mating contact for interim wiring changes.

Another object is the provision of a means and method for obtaining complete changeability of connector interfaces and allowing multiple commoning of conductors as required.

A further object is to provide a means and method for facilitating the design, prototype, and testing stages or the temporary and evolutionary changes of an electronic apparatus.

Another object is the provision of a means and method for retrofitting production wiring changes into previously produced cabling or harness systems without changing existing cabling or harness configurations.

Another object is to provide a means and method for retaining the physical identity of the cable or harness system while the wiring scheme is changed.

Another object is to facilitate the wiring or rewiring of an electronic apparatus without the requirement of special tooling.

Another object is to quickly implement wiring changes into an established design during development, production, or maintenance stages without disturbing the basic wiring scheme, cable or harness.

Other aims and objects, as well as a more complete understanding of the present invention will appear from the following explanation of exemplary embodiments and the accompanying drawings thereof, in which:

FIGS. 1a, b, and c are respectively side, end, and top views of one embodiment of the present invention configured for use with a rectangular style connector;

FIGS. 1d and e are perspective views of the embodiment depicted in FIG. 1 in exploded position and in assembled position;

FIGS. 2a, b, and c are respectively side elevational partly in cross-section, exploded perspective, and assembled perspective views of a second embodiment of the present invention for use with conventional round style connectors;

FIGS. 3a, b, and c are respectively side elevation, bottom, and assembled views of a third embodiment of the present invention with FIG. 3c additionally showing this embodiment secured to a conventional connector; and

FIGS. 4a, b, and c are perspective views of the illustrative third embodiment depicted in FIG. 3 illustrating a means by which a wiring change may be accomplished.

Accordingly, with respect to FIGS. 1a-e an intraconnector wiring change module 10 comprises a body 12 of suitable dielectric material which may be formed from several sections 14 including end sections 16 and 18 although, if desired, the body may comprise a single unsectionalized structure. Section 16 contains a plurality of female contacts 20 arranged in layers 20a, 20b, and 20c while section 18 is provided with a plurality of male contacts 22 arranged in layers 22a, 22b, and 22c. Each layer is progressively removed a greater distance than the succeeding layer from body axis 23 towards the surface of the body, the a layers being closest to axis 23 and the c layers being furthest from axis 23. Contacts 20 and 22 are configured to mate with well-known male and female terminals conventionally secured to the ends of electronic apparatus or harness or other type cables. Extending from the top and bottom sides of body 12 are a plurality of rows 24, 26, 28, 30, 32, and 34 of exposed connecting pins 35. Pins 35 may comprise any desired form such as "wire-wrap" pins, taper pins, "TERMAPOINT" (Trademark of Amp Inc.), etc.

As best shown in FIG. 1d, each row 24-34 of pins 35 is connected to individual intermediate connectors, such as connectors 36 secured to pins 30 and connectors 38 secured to pins 32. For pins 30, which are furthest removed in an axial direction from contacts 22, connectors 36 are placed closer to the center of sections 14 than connectors 38 whose pins 32 are not as axially removed from contacts 22 as pins 30. Connectors 36 extend through holes 40 in neighboring sections 14

and are connected to and terminate at contact layer 22a. Likewise, connectors 38 extend through holes 41 in a neighboring section 14 and are connected to and terminate at contact layer 22b.

In addition, as best shown in FIG. 1c, rows 24, 26, and 28 of exposed connecting pins 35 are connected to individual female contacts 20 while pins 35 of rows 30, 32, and 34 are connected to individual male contacts 22, that is, row 24 being connected to contact layer 20c, row 26 being connected to contact layer 20b, and so forth. Thus, each male and female contact 20 and 22 has its own individual exposed connecting pin 35. To prevent crowding of the wire-wrap pins, the pins extend from the top and bottom sides of body 12; however, the pins may be formed to extend about the entire periphery of the body. In order to rigidly assemble sections 14 into a unitary body 12, holes 42 in each of the sections are disposed to receive bolts and nuts, not shown. However, module 10 may be molded in a single piece, screw attached (see FIGS. 2a-c), or otherwise secured in any appropriate manner. A semi-permanent cam connectable type cover 44 and gasket 46 or a permanent potting protection may be placed over connected pins 35, as illustrated in FIG. 1c.

Referring to FIGS. 2a-c, a second embodiment of the present invention discloses an interconnector wiring change module 50. Module 50 comprises a plurality of sections 52, 54, 56, 58, and 60 from which radiate a plurality of rows 62, 64, 66, 68, 70, and 72 of exposed connecting pins 73. Section 54 is a separator section without any connecting pins to provide insulation between the connector pins and includes a key 74 which cooperates with a slot in section 52. Other sections have similar keys and slots to afford polarization and alignment knowledge of electrical and mechanical natures. Sections 52 and 60 terminate respectively in female contacts 75 and male contacts 76 both of which are configured in a concentric circular fashion so as to be mateable with conventional round style cable connectors and which comprise contact layers 75a, 75b, 75c for contacts 75 and contact layers 76a, 76b, and 76c for contacts 76. The arrangement of pin rows 62-72 and sections 52-60 are similar to that disclosed with respect to the embodiment of FIGS. 1a-e with the exception that the wire-wrap pins are distributed about the entire periphery of module 50 and radiate from the axis thereof. Also, pin row 62 is connected to contact layer 75c, pin row 64 is connected to contact layer 75b, etc.

After connections have been made among the several wire-wrap pins to readdress the wiring scheme, a hermetically sealed collar 78 [FIG. 2a] is installed over the module to protect the newly made connections. If the changes made are to be permanent, the interconnecting area of the readdressed pins may be potted instead of being protected as by hermetically sealed collar 78. Such a collar or plotting cover is illustrative as useful for all embodiments of the invention. Mating housings 80 and 82 are placed over the ends of the assembled sections. A collar 84 is provided with a flange 86 to engage housing 80 and with threads 88 to engage cooperating threads 90 on housing 82.

Now referring to FIGS. 3a-c, an intraconnector wiring change module 100 is configured to accept an edge-card connector. Module 100 comprises a body 102 having a plurality of female contacts 104 and a plurality of male contacts 106 which are disposed for mating with flat ribbon cable connectors. Rows 108, 110, 112, and 114 of exposed connecting pins 116 extend from body 100, rows 108 and 110 being secured to female contacts 104 and rows 112 and 114 being connected to male contacts 106. Although shown to extend from one side of module 100, the wire-wrap pins may be made to extend from both sides if so desired. After electrical connections have been made among the several pins 116, the pins are protected by a cam connectable type cover 117 and seal gasket 118 or potted, if the protection is to be permanent.

The use of the present invention is described with reference to FIGS. 4a-c utilizing the particular embodiment depicted in FIGS. 3a-c. FIG. 4a shows a flat ribbon cable 120 terminating

in an edge-card connector 122 which facilitates ease of connection of the cable. Conventionally, connector 122 is secured to a mating socket 124 so as to establish a particular wiring scheme.

To change the wiring scheme, the contacts are relabelled from the existing connector contact coordinates to a new male to female coordinate system by use of an intraconnector wiring change module 126 as depicted in FIG. 4b. Module 126 is then placed in-between connector 122 and socket 124. The male contacts 128 of connector 122 are plugged into female contacts 130 of module 126 and, in turn, the male contacts 132 of module 126 are plugged into female contacts 134 of socket 124. Wire-wrap pins 136 of module 126 are then interconnected according to the desired new wiring scheme with the aid of the new coordinate system, such as illustrated by connection 138, and the whole may be potted or enclosed by a collar, such as collar 78 of FIGS. 2a-c to seal and protect the newly formed interconnections. If such a collar and seal are utilized, they may be later removed without disturbing the assembly to allow further wiring changes as needed or desired.

Modules 10, 50, 100 and 126, although previously described for use in wiring scheme changes, are as adaptable to joining further cables and apparatus to existing cables and attaching test, checkout, programming and circuit analyzing equipment to the existing apparatus.

Although the invention has been described with reference to particular embodiments thereof, it should be realized that various changes and modifications may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. An intraconnector wiring change module comprising a body having input and output electrical contacts at opposed ends of said body

said input and output contacts being arranged in layers, each said layer being progressively removed from the preceeding layer in a direction away from the axis of said body,

said input and output contacts being shaped and arranged to receive electrical equipment terminals,

said body comprising a plurality of sections secured together each said section having a plurality of exposed connection pins arranged in a row and extending from said body substantially at right angles to the axis thereof to form with the others of said sections a plurality of pin rows extending parallel to each other

one-half of said pins having connections to said input contacts and

the other one-half of said pins having connections to said output contacts,

said pin rows axially furthest from said contacts having their connections to said layers of said contacts closest to the axis of said body and

said pin rows axially closest to said contacts having their connections to said layers of said contacts furthest from the axis of said body,

means for connecting at least one of said pins with any selected other one of said pins, and cover means for enclosing said pins.

2. An intraconnector wiring change module comprising a body having male and female contacts at opposed ends of said body for mating connection with cables and a plurality of exposed separate connecting pins extending from said body at an angle to said contacts, one-half of said pins being connected to and equal in number to said female contacts and the other one-half of said pins being connected to and equal in number to said male contacts.

3. A module as in claim 2 further including a removable collar placed about and sealed to said body and enclosing said pins.

4. A module as in claim 2 wherein said contacts are arranged in rectangular configuration for mating with rectangular wire connectors of said cables.

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5. A module as in claim 2 wherein said contacts are arranged in circular configuration for mating with round wire connectors of said cables.

6. A module as in claim 2 wherein said contacts are arranged in substantially flat configuration for mating with flat ribbon cable connectors of said cables.

7. A module as in claim 2 comprising a plurality of sections secured together, each said section having at least one of said pins and at least one connection from said one of said pins to at least one of said contacts.

8. A module as in claim 7 wherein said sections include polarization keying means.

9. A module as in claim 2 further including a permanent potting compound placed about and sealed to said body and enclosing said pins.

10. An intraconnector wiring change module adapted to connect first and second electric devices comprising a body having first contact means couplable to the first electric device and extending in a first direction, second contact means couplable to the second electric device and extending in a second direction other than the first direction, and intermediate individual connection means, one-half of said connection means being secured to and equal in number to said first contact means and the other one-half of said connection means being secured to and equal in number to said second contact means, and interconnection means coupling any one and more of said connection means among any two and more of others of said connection means for selective interconnection among said first and second contact means.

11. In an electronic apparatus requiring intermediate electrical interconnections between electrical terminals, a module having first contacts couplable to first ones of the terminals, second contacts couplable to second ones of the terminals, said first contacts having ends and said second contacts having ends, said ends being independent and free from coupling with each other and being exposed at the exterior of said module,

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and means coupling at least one of said exposed first contact ends with any selected number of said exposed second and other first contact ends.

12. A method for making a change in an electrical connection scheme in an electronic apparatus having a plurality of first terminals connected to a plurality of second terminals according to the connection scheme comprising the steps of:

utilizing a module having a plurality of input contacts mateable with the first terminals, a plurality of output contacts mateable with the second terminals, a plurality of exposed separate and independent first lead ends, each of said first lead ends connected to each of said input contacts, and a plurality of exposed separate and independent second lead ends, each of said second lead ends connected to each of said output contacts, and

connecting at least some of said exposed first lead ends to at least some of said exposed second and/or other first lead ends to effect the change.

13. A method for making a change in an electrical connection scheme in an electronic apparatus having a plurality of first terminals connected to a plurality of second terminals according to the connection scheme comprising the steps of:

utilizing a module having a plurality of input contacts mateable with the first terminals, a plurality of output contacts mateable with the second terminals, a plurality of separate and independent first lead ends, each connected to each of said input contacts, and a plurality of separate and independent second lead ends, each connected to each of said output contacts;

connecting at least some of said first lead ends to at least some of said second and/or other first lead ends to effect the change; and

placing a protective cover over said lead ends in sealing engagement with said module.

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